

GMBrowser User Manual

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Abstract

This note describes the usage of the gmbrowser histogram browser utility. gmbrowser is a package which can be used for monitoring histograms in real time. It is currently used by many of the online examine processes to display various quantities used in monitoring the health of the DØ detector and its data.

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1 Introduction

The gmbrowser process uses a straight-forward configuration file to specify pages of plots to display. Many options are available for determining the layout of each page as well as how each plot is displayed. Root macros can also be used to generate a given page. For each plot a reference histogram can also be overlaid to give the operator an idea of the ideal distribution for a given plot. Individual plots can also be tagged so that clicking on a plot will load a new configuration file. This allows one to have the ability to load expert plots associated with a given plot.

The program reads .root files that can be located on locally mounted disks or on remote systems. Remote files are accessed via the rootd protocol supported by root. More information about rootd can be found at <http://root.cern.ch>. The gmbrowser program can connect to .root files that are simultaneously being written to. This allows for a very flexible means of developing a monitoring system. Also, multiple input files can be specified which allows the gmbrowser to add together similar files from multiple processes.

2 Configuration Files

The behavior of gmbrowser is driven by a relatively simple configuration file. An example of such a file is shown in section 5. The main syntax of the gmbrowser configuration file is a directive followed by a value. All gmbrowser directives end in a colon. Comments can occur anywhere on a line and begin with a pound sign (#). Lines can be up to 255 characters long and blank lines are allowed.

The configuration file can be broken into three main parts: global directives, page directives and histogram definitions. The global directives specify the names of the data and reference histogram files, and the general behavior of gmbrowser. Table 1 lists the global configuration directives.

The second section of each configuration file specifies how each page of plots should look. This section is used to indicate how many plots should be displayed on each page and can also specify a macro to run to display a given page. Table 2 lists the page specific directives. Each page must have the Page.Title: directive and either a Page.Division: directive or a Page.Macro.File: (and Page.Macro.Function:) directive.

The third section of a configuration file contains the list of histograms to display and their respective options. In the case of a macro function, this section is not needed. The number of histograms defined cannot exceed the number specified in the Page.Division: directive. However, the number of histograms defined can be fewer than the Page.Division: directive. The format of the histogram definition line is as follows:

histogram name | histogram title [| options]

The histogram name is the name of the histogram in the .root file. The name of the histogram can include the subdirectory name if there are subdirectories defined in the .root file. The histogram title can be anything you choose, and can include white space. Options are used to customize the properties of each plot. By default each plot is displayed with linear scales, a plot title and the histogram statistics. Also, a reference histogram (if it exists) is overlaid on the histogram. Table 3 lists the available histogram options.

2.1 Specifying Root Files

The directives `Root.File:` and `Root.File.Ref:` are used to specify the path to the appropriate .root files. One can use the `root:` syntax in the file name to specify that the file will be accessed remotely. See <http://root.cern.ch/root/NetFile.html> for more information.

One can specify more than one `Root.File:` directive in a configuration file. This allows one to use a single gmbrowser process to look at histograms from many different processes (and servers). Just put the `Root.File:` (and `Root.File.Ref:`) directive ahead of the page definition. Any subsequent page will attempt to read the histograms from the appropriate file. There is no limitation on the number of files that can be accessed by gmbrowser.

2.2 Reference Histograms

The `Root.File.Ref:` and `Root.File.Ref2:` directives allow one to specify a .root file containing a reference histograms. These options permit one to indicate an ideal shape for each plot. The `.Ref2` directive allows one to show a second reference plot. At the moment, if the first reference histogram is not defined, the second reference histogram will not be displayed. For example if you have a high intensity and low intensity reference, they can both be shown on the same plot. The reference histograms can be turned off on a plot-by-plot basis. For each plot, just use the `noRef` or `noRef2` histogram option. By default, a Kolmogorov test is performed between the data plot and the reference plot. The result of the fit is displayed on each plot. To turn off this behavior, use the `noKolfit` histogram option.

2.3 Summing Histogram Files

The directive `Root.File.Add:` allows one to sum together multiple histogram files. This only applies to the data file and not the reference file. Adding one or more of these directives after the `Root.File:` directive will cause gmbrowser to sum the histograms from each of the specified files before displaying the appropriate page.

Directive	Values	Usage
Root.File:	File Name	Name of the .root file to be read by gmbrowser.
Root.File.Ref:	File Name	Name of .root file containing reference histograms.
Root.File.Add:	File Name	Name of file to sum together with the data histogram.
WWW.Dir:	Path Name	Name of directory to store .gif files for displaying on web server.
Load.Dir:	Path Name	Directory containing the configuration files. This is only necessary if you want to be able to read in a new configuration file while gmbrowser is running.
Save.Dir:	Path Name	Directory where .jpg, .ps and .eps files are written.
Update.On:	0 or 1	Turns on(1) or off(0) the automatic updating (i.e. rereading of the .root files). This feature is useful if the input .root file is being updated and you want to see an updated plot. By default Updating is turned off when gmbrowser starts.
Debug.On:	0 or 1	Turns on(1) or off(0) debugging statements. This option prints out a large amount of output. So, only use it if you are having a problem with gmbrowser.
Cycle.On:	0 or 1	Turns on(1) or off(0) the cycling through each defined page of histograms. By default, cycling is turned off when gmbrowser is started.
Update.Period:	Integer	Number of seconds between updates if updating is enabled.
Cycle.Period:	Integer	Number of seconds each page is displayed when cycling is enabled.
Cycle.Plots:	0 or 1	Turn off or on the generation of plots whenever the cycle option is chosen. This will generate .gif plots in the WWW.Dir and .ps plots in the Save.Dir areas. Default is on.
TotalEvent.Hist:	Histogram name	Name of a histogram used to determine the total number of events contained in the roottuple. gmbrowser gets the number of entries from this histogram and displays it at the bottom of the canvas.
RunNumber.Hist:	Histogram name	Name of histogram used to pass the run number. This is a 1-D histogram with a single bin. The area of the bin corresponds to the run number.

Table 1: List of Global Directives for Configuration Files

Directive	Values	Usage
Page.Title:	Page Name	Title for a given page of histograms.
Page.HelpFile:	File Name	Name of file containing a description of the plots on this page. This is just a text file which should contain useful information about the plots.
Page.Macro.File:	File Name	Name of a file containing macros. If a macro is defined, then one should not use the Page.Division and histogram definition directives. The file name should include the path to the macro file. It can either be the absolute path, or the relative path from where the executable is run. An example macro can be found in the macros directory.
Page.Macro.Func:	Function Name	Name of the macro routine to be executed. This directive should follow the Page.Macro.File directive. The name should just be the name. i.e. myfunc. Do NOT include the parentheses (i.e. myfunc()). The definition of myfunc should include the canvas, and pointers to the data and reference histograms.
Page.Division:	$\langle nx \rangle \langle ny \rangle$	Division of histogram page (i.e. nx by ny). Useful divisions are (1 1), (2 2) (2 3). Following the Page.Division command are the list of histograms for this page. Be sure to have no more than (nx) X (ny) histograms listed.
Page.ShowRunNumber:	0 or 1	Turns off/on option to show run number in given page.

Table 2: List of Page Specific Directives

Option	Result
logx	Use logarithmic x axis
logy	Use logarithmic y axis
logz	Use logarithmic z axis
limits(ymin:ymax)	Fix the min and max for the y axis. Be sure there are no spaces i.e. limits(0:500). If the maximum value is set to zero, then the maximum will float while the minimum will be set to the ymin value.
range(xmin:xmax)	Sets limits for x axis.
rebin(nbin)	Rebins with nbin bins.
scale_ymin(scale)	sets the minimum value of the y axis to be $\text{scale_ymin} \times \text{y_max} \times -1$. This is so that one can see the $y = 0$ values more easily.
stats(mode)	Change appearance of statistics box mode has form used in <code>gStyle->SetOptStat(1111)</code> .
lwid(width)	Set the histogram line width (in pixels) minimum number is 1.
config(<file.cfg>)	Associates a new configuration file with the named histogram. When the user double clicks on the displayed histogram, the new configuration file is read in and gmbrowser pages are updated. To return to the previous configuration file, click on the “Previous Config” button.
noscale	Doesn’t rescale the reference histogram to the displayed histogram.
noKolfit	Don’t perform the Kolmogorov test between the reference and displayed histogram.
noRef	turn off displaying of reference histogram.
noRef2	turn off displaying of the second reference histogram.
lego, surf, etc.	Any 2D plot supported by the root command <code>SetOption(option)</code>
Any root histogram option	i.e. H B C E E0 E1 E2 E3 E4 L P (for 1D plots) BOX COL etc. (for 2D plots)

Table 3: List of Histogram Options

2.4 Macros

If one wants to utilize the full power of root, one can write a macro that is executed whenever the page is displayed. If a macro is desired, then one does not specify any histogram names for that given page. Pages of macros can be interspersed with pages of defined histograms. The `Page.Macro.File:` directive specifies the name of the text file containing the macro. The `Page.Macro.Func:` directive then specifies the name of the macro function to execute for the given page. There can be more than one macro function defined in a given macro file. The function has to be specified in the following way in the macro file:

```
void myfunc(TCanvas *c1, TFile *data, TFile *ref)
```

The first argument is used to pass the pointer to the canvas where the plot will be drawn. The next two arguments specify the files for the data and reference histograms. Examples of macros for gmbrowser can be seen in the macros directory in cvs.

2.5 Expert Histograms

A feature that might be useful for a shifter is the ability to associate more detailed plots with a given plot. This is implemented by using the “config” histogram option. What this feature does is to load a new configuration file when a specific histogram is clicked on. So, if a user wants to find out the details of a given plot, he/she would click on that plot. This would have the effect of loading a new configuration file, and therefore show a new set of related plots. There is a “Previous Config” button on gmbrowser which reloads the previous configuration, thereby going back to the previous set of plots.

2.6 Plot Descriptions

By using the `Page.HelpFile:` directive, one can specify a text file describing the plots on a given page. If this directive is used, then a user can push the “Plot Info” button on gmbrowser, and the text file will be displayed in a separate window.

3 Building gmbrowser

The code for gmbrowser can be obtained from cvs. For example:

```
cvs checkout gmbrowser
```

To build the executable you need to have `$ROOTSYS` defined (i.e. setup root), and `$ROOTSYS/lib` must be included in `$LD_LIBRARY_PATH`.

Then, typing `make` in the `gmbrowser` top directory should properly build `gmbrowser`. Note that because of the way that `gmbrowser` implements macro files, you might get an error like “GMBrowser inherits from `TObject` but does not have its own `ClassDef`”. This error is not fatal and invoking `make` a second time usually fixes things.

4 Invoking and Running `gmbrowser`

Before running `gmbrowser`, you will need to create a few configuration files and set up some environment variables.

- `$GM_ICON_DIR` points to a directory containing icon files used by `gmbrowser`. If this environment variable is not set, a warning message is written by `gmbrowser` and a few buttons will not be available. However, you will be able to run `gmbrowser` even if this variable is not set. The icons are included in the `gmbrowser` cvs area.
- Create a configuration file (i.e. `TrigEx.cfg`). See below.
- `$HOME/.GMBrowser` Contains some start up preferences. This file is not necessary but will set defaults if it exists. The available `.GMBrowser` commands are listed in section 6.

`gmbrowser` can be started using the following syntax:

`gmbrowser` `<Configuration File>`

Once the process is running an x-window display should appear on the user’s workstation. There are four buttons on the top right of the display.

- Plot Info: This button brings up a text file (if it exists) describing the plots on the page.
- Prev Config: This button reloads the previous configuration file used. It is mostly useful when expert plots have been defined.
- Update: This button causes `gmbrowser` to reload the plots on the page after a predefined time limit.
- Cycle: This causes `gmbrowser` to cycle through all defined pages of histograms. When the browser is cycling, it automatically generates a `.ps` file of all current plots.

The File button at the top right allows one to make `.gif` and `.ps` copies of the current page of plots. One can also make a `.ps` file of all of the pages of histograms, though this takes a bit of time since `gmbrowser` has to cycle through all defined histogram pages.

Printing can be done via the File button. One has the option to print the currently displayed page, or all available pages. The default printer can be set in the .GMBrowser file.

The menu bar on the left hand side of the browser displays the list of all defined histogram pages. The current page is highlighted. If one wants to display a specific histogram page, one can just click on the appropriate page name.

If expert histograms are defined, clicking on a specific histogram plot will load a new configuration file that points to the defined expert plots.

Exiting from gmbrowser can be done through the File menu on the top left.

5 Sample Configuration File

```
#-----
# File: TrigEx.cfg
# Description: Configuration file for Global Monitor Histogram Browser
#               for Trigger Examine
# Created: 08-Oct-2002 Pushpa Bhat
# 12-Oct-2002 HBP move printer config to $HOME/.GMBrowser
# Add WWW.Dir etc.
#               23-Nov-2002 Pushpa Add MET plots
#               10-Dec-2002 ECC - Remove muon plots and add EM_HI_F0 plots.
#
#-----
# !!!!!!!! Important: Lines can not be longer than 255 characters.
# Configuration files
Load.Dir: $GM_SCRIPTS_DIR

# Plots etc.
Save.Dir: .
WWW.Dir: /mnt/www/htdocs/groups/gm/TrigEx

Root.File: http://kaon1.physics.arizona.edu/~elliott/TrigEx.root
Root.File.Ref: http://kaon1.physics.arizona.edu/~elliott/TrigEx_ref.root

Update.Period: 3 # seconds
Cycle.Period: 10 # seconds

Page.Title: L1 Muon Triggers
Page.Helpfile: $GM_HELP_DIR/L1Muon.hlp
Page.Division: 2 2
L1Mu_ScintTrigs | L1 Muon Scintillator Triggers
L1Mu_WireTrigs | L1 Muon Wire Triggers
L1Mu_BOTTrigs | L1 Muon Beginning of Turn Triggers
```

```

Page.Title:    L2 global Jets
Page.Division: 3 2
h_N_L2jets    | number of L2 jets
h_Pt_L2jets   | pt of L2 jets
h_Eta_L2jets  | eta of L2 jets
h_Phi_L2jets  | Phi of L2 jets
h_EtaPhi_L2jets | eta vs. phi of L2 jets

```

```

Page.Title:    L2 global EM Objects 1
Page.Division: 3 2
h_N_L2emobjects | Number of L2 EM objects
h_Pt_L2emobjects | L2 EM objects Pt
h_Eta_L2emobjects | L2 EM objects Eta
h_Phi_L2emobjects | L2 EM objects Phi
h_EtaPhi_L2emobjects | L2 EM objects Eta vs Phi

```

```

Page.Title:    L2 global EM Objects 2
Page.Division: 1 2
h_Iso_L2emobjects | L2 EM objects Iso
h_EMFrac_L2emobjects | L2 EM objects Emfraction

```

```

Page.Title:    Macro Test
Page.Macro.File: test.C
Page.Macro.Func: myfunc

```

6 Sample .GMBrowser file

This section lists all of the available commands that can be used in the .GMBrowser file.

```

Created:        Fri Oct 11 00:37:52 2002
Printer.Command: flpr -q
Printer:        dab1_hp8000
Canvas.Color:   42
Update:         yes
Cycle:          yes

```

7 Summary

The gmbrowser program provides an easy way to connect to running processes to view histograms. It is controlled by a single configuration file that is read in at run

time. gmbrowser can be used to view processes running locally or remotely and provides a number of tools that allow one to easily control the look and feel of the browser.